Giant Cell Tumor of the Distal End of the Radius Replaced by a Free Autogenous Proximal Fibular Graft : Long-term Follow-up of Two Cases

AUTHOR(S):

NAKATA, KAZUYOSHI; TERAYAMA, KAZUO

Arch Jpn Chir 54(6), 498～507, Nov., 1985

臨　　床

Giant Cell Tumor of the Distal End of the Radius Replaced by a Free Autogenous Proximal Fibular Graft: Long-term Follow-up of Two Cases

KAZUYOSHI NAKATA and KAZUO TERAYAMA

Department of Orthopaedic Surgery, Shinshu University School of Medicine
Received for Publication August 6, 1985.

Abstract

Two cases of giant cell tumor of the distal end of the radius replaced by a autogenous fibular graft after en bloc resection were reported. Follow-up at 20 years of one case and 15 years of the other revealed good function of the wrist and no evidence of the tumor.

Introduction

Giant cell tumor of bone is a locally aggressive tumor. The distal end of the radius is one of the common sites affected, next to the distal femur and proximal tibia[4,7]. Many methods have been advocated for the management of this tumor in the distal end of the radius. After curettage and bone grafting there is a high recurrence and the tumor is often more aggressive[1,7]. En bloc resection or amputation is consistently curative and in the upper limb, resection and autogenous replacement of the upper end of the fibula is a useful procedure[11,12,17,18]. This paper reports on two patients with giant cell tumor in the lower end of the radius who underwent autogenous replacement of the upper third of the fibula and satisfactory function of the wrist was obtained even after long term observation.

Case histories

Case 1. A 41-year-old right-handed woman, who is a knitting instructor, complained of pain and swelling in the wrist one year before examination. She was admitted to our hospital with a bony tumor of the radius. General examination was normal. There was a diffuse swelling over the dorsal aspect of the lower end of the wrist which was very tender on pressure. The overlying skin was slightly warmer than that of the opposite wrist, and her wrist movement's were

Key words: Giant-cell tumor, Distal end of the radius, A free autogenous proximal fibular graft, Long-term follow-up.
索引語：骨巨細胞腫，橈骨下端，遊離腓骨移植，長期経過観察.
Present address: Department of Orthopaedic Surgery, Shinshu University School of Medicine, Asahi 3-1-1, Matsumoto 390, Japan.

moderately restricted by pain, and grasp was very weak. The consistency of the tumor was elastic with some osteal hardness. Neither adhesion to the skin nor fluctuation was noted. Sensation and circulation in the fingers were within normal limits. X-ray showed a multilobular osteolytic lesion in the distal end of the radius which was expanding and the thin cortex was partly destroyed. The x-ray report was "giant cell tumor or aneurysmal bone cyst" (Fig. 1-a, b). ^{99m}Tc-MDP bone scan was negative except for the lesion itself.

No abnormalities were found in the sedimentation rate, complete blood count and alkaline phosphatase.

Procedure. A posterolateral skin incision was made, the superficial branch of the radial nerve was identified, dissected and retracted. The radius was exposed by retraction through the brachioradialis and the extensor carpi radialis. The distal end of the radius with its periosteum and the involved soft-tissue elements was exposed from five centimeters proximal to the tumor mass extending to the wrist joint. The lower end of the radius was osteomized while maintaining a satisfactory proximal margin of normal tissue. All the ligaments of the wrist were dissected and preserved. The defect created by resection of the distal part of the radius was replaced by a free autogenous proximal fibular graft for the reconstruction of the wrist joint. All the ligaments were resutured to the new radius and a plaster cast was applied for three months.

Histology showed the lesion to be a giant cell tumor.

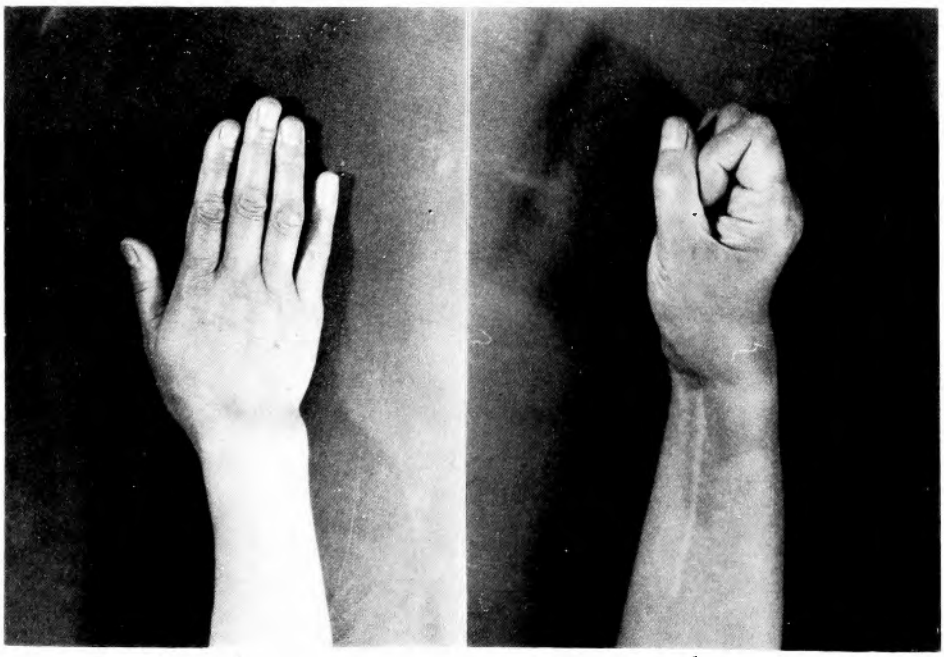
The postoperative course was uneventful and the distal site of osteosynthesis healed in four and a half months (Fig. 2-a, b). Two years after the operation the patient had a remarkable improvement in the joint motion of the right wrist joint compared with the preoperative state and engaged in her normal activity as a knitting instructor. Now, 20 years after the operation, she

a b

Fig. 1-a, b. Case 1. X-ray of the wrist showing an osteolytic lesion of the distal radius with cortical invasion suggestive of giant-cell tumor.

a b

Fig. 2-a, b. Case 1. Four and a half months after operation osteosynthesis has occurred.



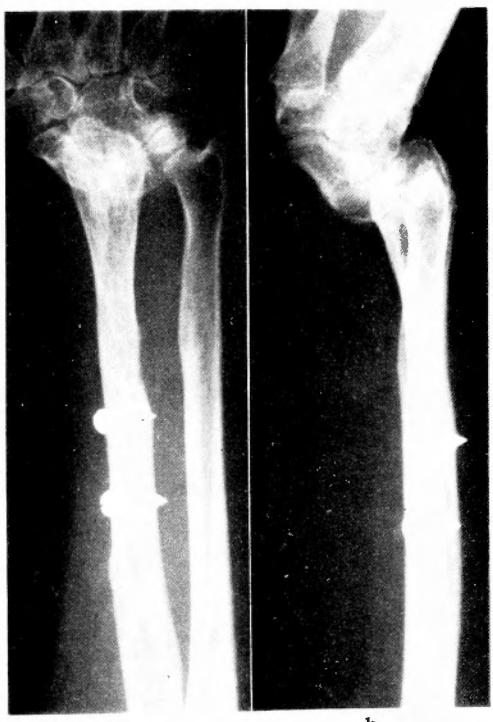
a b

Fig. 3-a, b. Case 1. Twenty years after operation the patient has a pain free, functional wrist. The wrist joint shows flexion deformity.

has a pain-free, functional wrist. The right wrist joint shows flexion deformity (palmar dislocation of the carpal bone, Fig. 3-a). Wrist dorsiflexion is 40°, palmar flexion is 20°, radial deviation is 15°, ulnar deviation is 20°, forearm supination is 90°, and pronation is 50°. The grip strength of her right hand is 23 kilograms, and the left hand 30 kilograms, while no functional disturbance was noted in her right hand (Fig. 3-b). X-ray shows no evidence of tumor recurrence but palmar dislocation of carpal bone (Fig. 4-a, b).

Case 2. A 28-year-old right-handed farmer noted an egg-sized tumor on the radial side of the right wrist joint, eight years prior to admission to hospital. He noticed increasing swelling and pain in his wrist one year before examination and was admitted to hospital with the diagnosis of giant cell tumor.

There was diffuse swelling over the dorsal aspect of the lower end of the right wrist which was warm and tender on pressure. The surface of the tumor was smooth and of mixed consistency. Wrist movements were limited by pain. Voluntary power, sensation and circulation of the fingers were within normal limits. X-ray showed a soap bubble appearance with a osteolytic lesions at the distal end of the radius (Fig. 5). The cortex was bulging and thin with some defects. Angiography showed a hypervascular tumor, and total body ^{99m}Tc-MDP scan showed no evidence of metastasis. The sedimentation rate, complete blood count and alkaline phosphatase were within normal limits. A biopsy confirmed the diagnosis of giant cell tumor.



a b

Fig. 4-a, b. Case 1. Twenty years after operation, X-ray shows no evidence of tumor recurrence and palmar dislocation of carpal bone.

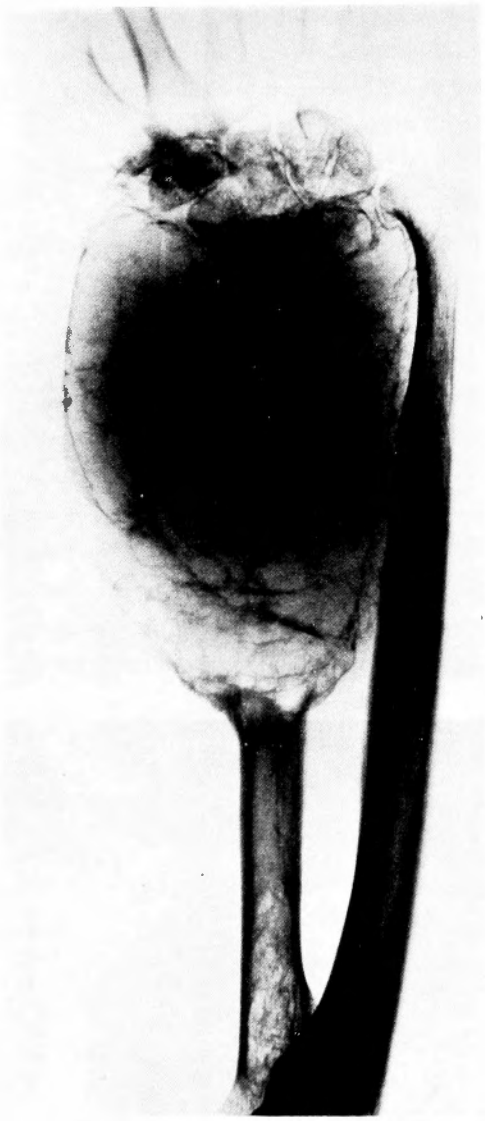


Fig. 5. Case 2. X-ray shows a soap-bubble appearance of osteolytic lesions in the distal end of the radius.

Procedure. Through a longitudinal skin incision, the biopsy scar and soft tissue down to the dorsum of the radius were excised. The extensor tendons were retracted radially, and the radius divided 8.5 cm proximal to its distal articular surface. The brachioradialis was detached and the radiocarpal and radioulnar ligaments were transected just proximal to their distal attachments. The pronator quadratus was excised with the radius. The proximal portion of the patient's right fibula was removed and inserted into the wrist as a replacement for the resected articular end of the radius with a plate. A longitudinal Kirschner wire was inserted through the carpal bones into the distal end of the fibula in order to stabilize the wrist. The ligaments attached to

the fibula were sutured to the distal end of the patient's transected radiocarpal and radioulnar ligaments with interrupted silk sutures. The wound was closed, and a long arm plaster cast was applied with the wrist and forearm in the neutral position.

Histologic examination of the resected bone revealed tumor extending close to the articular cartilage but not through the periosteum.

The Kirschner wire was removed four weeks after operation and the plaster cast was removed after four months, at which time x-ray showed good union of the graft (Fig. 6-a, b). The patient has had no trouble in daily life, and returned to work one year after the operation. 15 years later, he has no complaints and no trouble in daily life. There is volar dislocation of the carpus with radial deviation (Fig. 7). Wrist dorsiflexion is 30°, volar flexion is 0°, radial deviation is 20°, ulnar deviation is —5°, forearm pronation is 70°, and supination is 50°. The grip power

a b

Fig. 6-a, b. Case 2. Four months after operation, x-ray shows good union of the graft without palmar dislocation.

Fig. 7. Case 2. The functional result is satisfactory 15 years after operation. There is volar dislocation of the carpus with radial deviation.

is 40 kg for the right and 45 kg for the left wrist. X-ray shows partial ankylosis between the carpus and the grafted bone with volar subdislocation (Fig. 8-a, b).

Discussion

Various methods of treatment have been suggested for giant cell tumor occurring at the lower end of the radius[1~3,5~8,10~23]. Curettage and bone grafting of the lesion have the advantage of preserving joint function, but the recurrence rate is more than 50%[1,7]. This method is applied to the cases in which the lesion is not occupying the subchondral bone. Recently, curettage has been extended in its application employing cryosurgery[13] and cement.

En bloc resection of the tumor appears to be the preferred treatment[1]. Following distal radial resection, many methods have been proposed to achieve wrist stability and joint function. Although few data are available on functional results with the various methods, e.g. arthrodesis with a free iliac bone graft which is fused to the carpus and the radius[22], dual tibial autogenous grafts combined with wrist arthrodesis[10,14], use of the proximal end of the fibula as a graft to arthrodese the wrist[1,23], and the tibial corticocancellous graft[3] and distal ulnar translocation[19]. A radial allograft is useful for reconstruction the wrist joint[20]. PARRISH[15] used homograft implants with some excellent results, but degenerative changes are expected to develop in future. One attempt to use a prosthetic implant failed[5,6]. Although an artificial implant has an early favorable result, it is considered that pain and worsening of joint motion may occur in the

a b

Fig. 8-a, b. Case 2. X-ray shows partial ankylosis between the carpus and the grafted bone with volar dislocation.

future[2,6]. A free autogenous proximal fibular graft to replace the distal end of the radius has been reported to give good functional results in some cases[10–12,17,18]. However this method may lead to osteoarthritic changes of the articular surface of the fibula due to incongruity of the joint surfaces, resulting in a painful, dislocated and relatively immobile wrist joint[1,10,11,15,21]. Patient 1 has had no pain for 20 years with excellent joint motion, although palmar dislocation is present in the wrist. Resection and arthrodesis is also useful method to stabilize the wrist joint in giant cell tumors of the distal radius[10,14,23]. Once the wrist joint has been fused, the range in the small joints increases and, about 1/2 the normal wrist movements as well as forearm pronation and supination can be obtained[1]. Patient 2 has osteoarthritic changes between the grafted fibula and the proximal calpal bone. Arthrodesis has occurred spontaneously, resulting in decreased joint movement, but painless joint stability has been preserved for 15 years. This man who does heavy labor should have had an arthrodesis of the wrist joint at the time of the first operation, although the results accomplished were resection and arthrodesis. Patient 1 is a woman who works as a knitting instructor, and she is satisfied with her excellent wrist motion. Patient 2 is a farmer, and he is satisfied with his wrist function and stability, rather than joint movement. The advantage of fibular grafting for giant cell tumor of the radius is a functionally stable wrist with a good range of motion at long term follow up. A good indication for this operation is in young females and males who are keen to preserve wrist movements. Arthrodesis

should be done in relatively old persons or in patients who have to perform heavy manual work. It is not necessary to replace the artificial joint in giant cell tumor of the distal radius. A free autogenous fibular graft should replace a vascularized fibular transplant which has the great advantage of early bone union of the graft and enables the patient to regain limb function early[16].

References

1) Abe M, Ogino M, et al: Giant-cell tumor of bone. Clin Orthop Surg **3**: 1016–1036, 1968. (in Japanese)
2) Akahoshi Y, Yonezawa H, et al: The treatment of giant-cell tumor of bone. Clin Orthop Surg **1**: 669–681, 1966. (in Japanese)
3) Campbell CJ and Akbarnia BA: Giant-cell tumor of the radius treated by massive resection and tibial bone graft. J Bone and Joint Surg **57**-A: 982–986, 1975.
4) Dahlin DC, Cupps RE, et al: Giant-cell tumor: a study of 195 cases. Cancer **25**: 1061–1070, 1970.
5) Gold AM: Use of a prosthesis for the distal portion of the radius following resection of a recurrent giant cell tumor. J Bone and Joint Surg **39**-A: 1374–1380, 1957.
6) Gold AM: Follow-up notes on articles previously published in the journal. Use of a prosthesis for the distal portion of the radius following resection of a recurrent giant-cell tumor. J Bone and Joint Surg **47**-A: 216–218, 1965.
7) Goldenberg RR, Campbell CJ, et al: Giant-cell tumor of bone. An analysis of two hundred and eighteen cases. J Bone and Joint Surg **52**-A: 619–664, 1970.
8) Higginbotham NL and Coley BL. The treatment of bone tumors by resection and replacement with massive grafts. In Instructional Course Lectures. The Academy of Orthopaedic Surgeons. vol. 7, pp. 26–33. Ann Arbor, J W Edwards, 1950.
9) Jaffe HL: Tumors and Tumorous Conditions of the Bonesand Joints, pp. 18–43. Philadelphia, Lea and Febiger, 1958.
10) Johnson EW Jr and Dahlin DC: Treatment of giant-cell tumor of bone. J Bone and Joint Surg **41**-A: 895–904, 1959.
11) Lawson TL: Fibular transplant for osteoclastoma of the radius. J Bone and Joint Surg **34**-B: 74–75, 1952.
12) Mack GR, Lichtman DM, et al: Fibular autografts for distal defects of the radius. J Hand Surg **6**: 576–583, 1979.
13) Marcove RC, Weis LD, et al: Cryosurgery in the treatment of giant cell tumors of bone. A report of 52 consecutive cases. Clin Orthop **134**: 275–289, 1978.
14) Meary Robert: Wide resections in bone tumors (except pelvis and knee). In Operative Treatment of Bone Tumors, pp. 89–91. edited by Geoge Chapchal. Stuttgart, Georg Thieme, 1970.
15) Parrish FF: Treatment of bone tumors by total excision and replacement with massive autologous and homologous grafts. J Bone and Joint Surg **48**-A: 968–990, 1966.
16) Pho RWH: Free vascularized fibular transplant for replacement of the lower radius. J Bone and Joint Surg **61**-B: 362–365, 1979.
17) Pitcock JA: Resection of distal radius and substitution by fibular graft. In Campbell's Operative Orthopaedics/fifth edition. edited by AH Crenshaw. Vol. *II*, pp. 1425–1428. St Louis: C. V. Mosby Co. 1971.
18) Sakellarides HT: Extensive giant-cell tumor of the lower end of the radius. a report of 1 case treated by resection and replacement with the fibula.
19) Seradge H: Distal ulnar translocation in the treatment of giant cell tumors of the distal end of the radius. J Bone and Joint Surg **64**-A: 67–73, 1982.
20) Smith RJ and Mankin HJ: Allograft replacement of distal radius for giant cell tumor. J Hand Surg **4**: 299–308, 1977.
21) Stewart MJ and Richardson TR: Giant-cell tumor of bone. J Bone and Joint Surg **34**-A: 372–386, 1952.
22) Wilson PD and Lance EM: Surgical reconstruction of the skeleton following segmental resection for bone tumors. J Bone and Joint Surg **47**-A: 1629–1656, 1965.
23) Windeyer BW and Woodyatt PB: Osteoclastoma. A study of thirty-eight cases. J Bone and Joint Surg **31**:B- 252–267, 1949.

和文抄録

遊離腓骨頭を置換した橈骨下端骨巨細胞腫
——2例の長期経過観察——

信州大学医学部整形外科
中田　和義，寺山　和雄

橈骨下端に発生した骨巨細胞腫に対して，広範囲切除後遊離腓骨移植術を施行した2例の長期経過観察例を報告した．症例1は41才女性の右橈骨下端骨巨細胞腫に対して，広範切除後，腓骨頭を置換し，手関節を形成した．術後20年の経過では疼痛なく，手関節の運動性は良好で編物業をやっている．X線像では手指骨の掌側脱臼がみられるが，関節症悪化は認められなかった．症例2は28才男性の右橈骨下端の骨巨細胞腫に対して，広範切除後腓骨頭を置換した．術後15年の経過では疼痛なく，手関節の運動は軽度制限が認められるが，農業に従事している．X線像では一部手関節強直状態になっており，手根骨掌側脱臼が認められる．橈骨下端骨巨細胞腫に対して遊離腓骨頭置換術は長期経過観察から，いい治療法であり，人工手関節置換の必要性を認めない．